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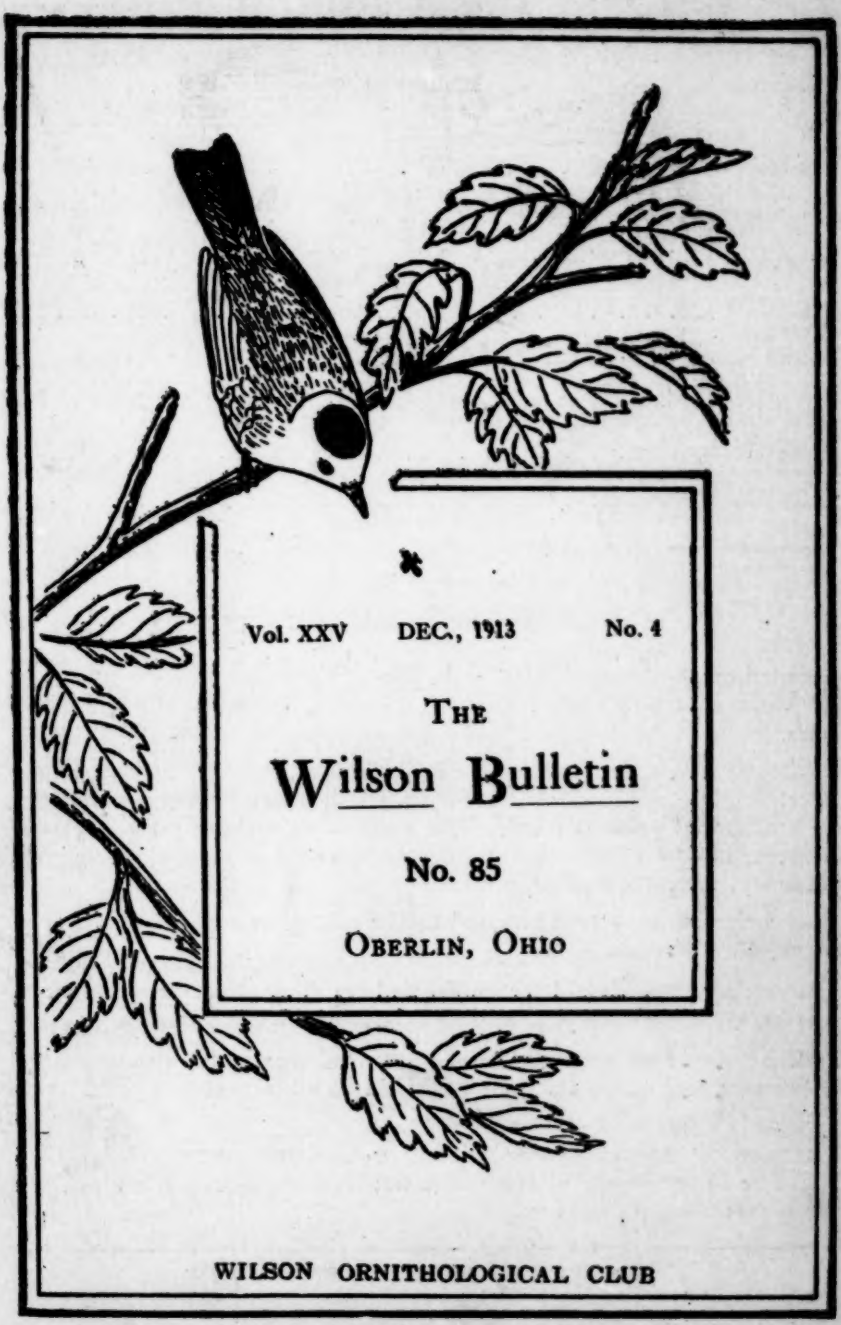

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EXPERIMENTS IN FEEDING HUMMINGBIRDS DURING SEVEN SUMMERS.[1]

BY ALTHEA R. SHERMAN,
NATIONAL, IOWA.

The experiments herein described were begun without intending them to bear upon the question of the food naturally sought by the Ruby-throated Hummingbird (*Archilochus colubris*); the original aim of the feeding was to attract the Hummingbirds about the yard in the hope that sometime they would remain to nest there. The experiments have been conducted on independent lines without knowledge of any similar work that was being done by others until the autumn of 1912, except in one instance, where special acknowledgments are due Miss Caroline G. Soule of Brookline, Mass., who in Bird-Lore for October, 1900, described her success in feeding Hummingbirds from a vial, which she had placed in the heart of an artificial trumpet-flower made from Whatman paper and painted with water-colors. This suggestion of using artificial flowers was taken, but more durable ones were made from white oil-cloth, their edges were stiffened with one strand of wire taken from picture cord, and they

[1] Read at the 31st Annual Congress of the American Ornithologists' Union, New York City, Nov. 11, 1913.

were carefully painted with oil colors, the first to represent a nasturtium, and the second a tiger-lily.

In August of 1907 upon the appearance of a Hummingbird about our flowers the artificial nasturtium, tacked to a stick, was placed near a clump of blooming phlox, and its bottle was filled with a syrup made of granulated sugar dissolved in water. The next day a female Ruby-throat was seen searching the depths of tiger-lilies that grew north of the house; as she flew to the east of the house she was instantly followed, and was seen drinking from the artificial flower for the space of about a minute, after which she flew to a rose-bush, wiped her bill and rested a brief time before flying away. This was about noon. She returned at intervals of about a half hour for the next three hours, then at 3:10 o'clock she came back to search quite thoroughly the phlox blossoms, this being the first time she had paid any attention to them after finding the syrup. Ten minutes later she drank deeply from the bottle, and was seen no more that day.

In this way began the feeding of the Ruby-throated Hummingbirds, which has been continued each summer since 1907 with a varying number of birds. The first season it appeared that but a single bird found the bottled sweets. Perhaps it was the same bird that came the following summer, and was not joined by a second Hummingbird until the latter part of August. In 1909 the number was gradually augmented until seven of these birds were present together. The following year there were days when again seven came at one time; since then four have been the largest number seen together.

The days and weeks are calm and quiet ones when a single bird has the bottles to herself. More or less fighting ensues as soon as another bird comes on the scene, and the tumult of battle increases with each new arrival until the presence of six or seven of these tiny belligerents makes the front yard appear like the staging of a ballet. With clashing sounds and continuous squeaking cries they chase each other about, often swinging back and forth in

an arc of a circle with a sort of pendulum-like motion. Sometimes they clinch and fall to the earth where the struggle is continued for many seconds. So jealous are they lest others share the syrup that they seem more anxious to fight than to drink. When seven are present they are very difficult to count, and appear to be three-fold that number. We have read accounts of forty or a hundred Hummingbirds hovering about a tree or bush. Clearly these numbers must have been estimates, probably large ones, too, any one must believe, who has made sure that only seven birds have created the maze of wonderful and beautiful motion in which there seemed to be a dozen or a score of participants.

The number of bottles in use has been sufficient on most days to satisfy the needs of all the Hummingbirds present. Each new bottle has been added by way of an experiment. The first one was placed in an artificial flower painted to imitate a nasturtium, mainly yellow in color; the second flower in form and color closely resembled a tiger-lily. The experiment with the yellow and the red flowers was to test a supposedly erroneous theory which had been published to the effect that Hummingbirds show a preference for red flowers. In further proof of the fallacy of this statement the third flower, shaped like the nasturtium, was painted green, and was placed in a bed of green plants which at that time bore no blossoms. It was pronounced by other people to be "exactly the color of the surrounding foliage." It was staked out and filled on August 5, 1909, when no Hummingbird was in sight, but in about ten minutes some of the species had come, and fifteen minutes later one was drinking from the bottle in this green flower.

It was then suggested by my sister, Dr. E. Amelia Sherman, that I try a bottle without an encircling flower. The problem of supporting a bottle without an artificial flower was solved in this way: The bottle was encased in a piece of unbleached muslin, enough of the cloth extending beyond the bottom of the bottle to allow the tacking of it to a stick. The support of the bottle in a position slightly up from the

horizontal was furnished by a piece of leather with a hole in it through which the bottle was thrust, and the leather was then nailed to the stick. In this arrangement the most vivid imagination can find no suggestion of a flower. It was put out on August 8, and in forty-three minutes a Hummingbird was drinking from it. The bottle was then moved from proximity to the artificial nasturtium and tiger-lily, and a Hummingbird found it in its new location in thirty-two minutes. This place about eight feet from the artificial flowers has been its position in the four succeeding summers. In July, 1911, two more flowerless bottles were added to the group, making six in all. For convenience in referring to them the flowerless bottles will be called by numbers 4, 5 and 6.

Bottle No. 4 had not been long in use before it was noted that the Hummingbirds showed preference for it, while the nasturtium was sought least of all. This seemed due to the deep insetting of the bottle in the flower, which caused the birds to brush against its lower leaves, an unpleasant experience when sticky syrup adhered to it. For this reason the filling of the nasturtium was sometimes omitted for several days whereupon the Hummingbirds soon ceased to visit it, although drinking regularly from the tiger-lily a few inches away. When the filling was resumed the birds returned to it as they had been accustomed.

In the fourth season of experiments the bottle held by the green flower was put out when the others were, but was not filled for six weeks. During that time Hummingbirds were present and drinking on twenty-three days. It is safe to say that they were seen drinking fully four hundred times from the other bottles, but never once were they seen to approach the green flower. The first morning it was filled four of them were about the yard and one drank from this flower two minutes after the filling. The following year (1911) after dark on July 14 the green-flower bottle was set in its bed of green and was left empty for a few days. About noon on the 17th one of the Ruby-throats visited it, thrust-

ing in her bill; the bottle was then filled for the first time that year, and in a half minute a bird was drinking from it. To this is added a transcript from my journal bearing date of July 17, 1912; "About 9 A. M. before I had put out any syrup a Hummingbird was dashing from bottle to bottle and tried the green-flower one. It was bent over in the green foliage, and certainly has had no syrup in it for six weeks or longer. I filled it after I saw the bird visit it, and she came again to drink."

The new bottles No. 5 and No. 6 covered like No. 4 with white muslin and nailed to a weather-beaten fence picket were put out after dark on July 23, 1911, but neither was filled for one week. The next morning about eight o'clock a Hummingbird was searching one of these bottles for suspected sweets; four such visits were noted in one day and on several other occasions. At the end of the week the filling of No. 5 began but no syrup was put in No. 6 for two years. During these years a record was kept of each time a Hummingbird was seen to visit and search this unfilled bottle, and the total number was fifteen in addition to those visits already mentioned.

Thus far this writing has been confined to a description of the things seen; no theories have been advanced, no deductions have been made, no hypotheses have been carried to their logical conclusion. The first deduction offered is, that at the beginning of the experiments in 1907 the artificial nasturtium may have led the Hummingbird to explore its depths, and finding its contents to her taste she returned to it. Other birds may have found the syrup there in the same way, yet it seems more likely that most of them were led to the bottles by seeing another drinking. This probably was the case with the Catbirds that have drunk from the bottles on several occasions, although they have found it an inconvenient performance. The same may be true of a pair of Chickadees that drank as long as they remained with us. They clung to the stiff leaves of the tiger-lily and found no difficulty in the way of drinking. Only one Hummingbird

learned to perch on this flower and drink from it while standing. From the earlier experiments it was suspected that the Hummingbirds found the syrup through some sense, rather than stumbling upon it by chance or through imitation, but several things disprove such a supposition. The principal one is that migrants passing through the yard in the spring, but more especially in the fall, fail to find the syrup. That these migrants can be recognized as such by their behavior will be shown farther on.

The twenty-five or more visits paid to bottles No. 5 and No. 6 before they were filled for the first time show that the birds recognized them as receptacles for their food, though they were new bottles occupying new locations. To make sure that the birds should not be attracted to them by seeing me stake the pickets out this work was done after dark. The first summer that No. 6 was out frequent pretenses of filling it were made in sight of the birds, but no response followed. The next summer no such pretenses were made yet a Hummingbird was seen to search this unfilled bottle on May 12 and 31, twice on June 1, on July 21 and 26, on August 4, 7, 12, 23 and 26.

One is led to wonder if the Homeric gods on high Olympus were more deeply stirred by the appearance among them of the youthful Ganymedes bearing cups of nectar, than are the Hummingbirds at sight of their cup-bearer. When several of them are present the wildest confusion reigns. Possibly not one of them is in sight when the door is passed, yet instantly the air seems filled with them: some swinging back and forth in the air, squeaking and fighting, or darting from bottle to bottle thrusting in their bills as they pass, while an over-bold one will buzz about my head, sometimes coming under the porch in her zeal for the meeting; but the timorous ones fly from their perches into sight over the bottles then back into a bush. Some one of these types of behavior marks the bird boarder from the migrant. The latter pays no attention to cup-bearer or bottle but diligently searches each bunch of blossoms. For two or three weeks

after the drinking birds have left there is occasionally a migrant among the natural flowers. The bottles are full of syrup but it passes them unheedfully.

Habits seem to change when steady drinking is practiced, but in the case of the birds the habit does not appear to be a harmful one. At once she ceases to search the flowers and, like the typical summer boarder, she sits and waits for the food to be served. Each bird appears to have her favorite perch, a dead twig of syringa or lilac bushes on the north, or on the south in one of the snow-ball bushes; the telephone wires on either side of the street offer acceptable waiting-places at times. Not infrequently I have been intent upon other duties about the yard and looking up have found a Ruby-throat perched directly over-head, her bright eyes seeming to say "I want to be fed." So complete appears the cessation of the search for other food that it led to the keeping of a full record for the past three years of every time one of these birds has been seen catching insects or searching the natural flowers for food. Most of these instances noted were, if the whole truth could be learned, probably, cases of strangers just arrived within our gates, that had not yet acquired the drinking habit.

In 1911 the drinking birds were about our place on forty-three days. During that time on only four occasions was a Hummingbird seen catching insects or probing the flowers. A large number of plants called "Star of Bethlehem" had been raised, these flowers in previous summers having proved a great attraction to the Ruby-throat in the yard of a friend living two miles distant; but our drinking birds were never seen to visit these flowers. After their departure strange Hummingbirds searched them thoroughly as well as the phlox, tiger-lilies, sweet peas, nasturtiums and clover. These strangers were present on twelve days. In 1912 the drinkers were with us on seventy-seven days, and were seen but ten times seeking other food than syrup. In 1913 for forty-nine days the drinking birds imbibed, and on nine occasions a Hummingbird was seen gathering food elsewhere. In the

169 days that make the grand total for the three summers the Ruby-throats were seen drinking syrup between one and two thousand times, they were seen collecting food away from the bottles twenty-three times, but one cannot be positive that insect food was always taken then. Never for an instant was one of these birds in captivity, and there was the utmost freedom for it in choice of food.

This choice of a sugar diet together with the large amount consumed caused surprise and soon called forth the estimate that a Hummingbird would eat a tea-spoonful of sugar in one day. Some method of testing this estimate was sought, resulting in a plan for putting the bottles beyond the reach of the ants that swarmed about them: The stick that supported the artificial nasturtium and tiger-lily was nailed to a block of wood which was submerged in a flower-pot filled with water. For a short time this arrangement served very well until leaves and flower petals fell in forming rafts upon which the ants were able to cross. No myrmecologist was at hand to suggest a remedy, but at last ants' aversion to kerosene was recalled and the water was covered with a film of kerosene, which effectually debarred them. Nevertheless one day the ants were found taking the syrup as of old; an examination of existing conditions showed that a grass stem had lodged against the supporting stick, forming a bridge over which these wise little creatures were busily passing to and fro. Except when the bottles were isolated in this manner ants of various sizes and different colors fed constantly on the syrup often crowding a bottle to its very mouth, but this did not prevent the birds from drinking. I am not prepared to say that they never took an ant as food, but I have stood as closely as is possible to a bottle while a Hummingbird was drinking from it, and none was taken at such times. When a new bottle was placed, or the old ones were set out in the spring and filled it took from one to two days for the ants to find the syrup. A small red species generally, if not always, was the ant to make the discovery, the fruits of which it enjoyed

for a very brief season, a large black ant soon taking possession and holding the spoils for the rest of the summer.

The bottles, having been removed from the encroachments of the ants, were ready for the first test. One bird being the sole boarder at that time a level tea-spoonful of sugar dissolved in water was consumed by her daily. In time two, three, four and five Hummingbirds having joined her the quantity of sugar was increased accordingly, a spoonful or two being added to offset any possible waste. In this way more than a pound of sugar was eaten in twenty days, or to be more exact three cupfuls, weighing 9252 grains; which made an average of 462 grains per day. This for the six birds frequently counted as present confirmed the first rough estimate of a tea-spoonful of sugar daily for each bird.

Another method of estimating the amount eaten was devised. On several days the sugar and the water were carefully measured and weighed, then weighed and measured again, after which the syrup resulting from their combination was also measured and weighed, until I felt confident that in a dram of the thinnest syrup served there were forty grains of sugar, or two-thirds of a gram to every drop. But the syrup usually used was considerably richer than this, easily containing a grain of sugar in every drop; but it seems best in giving the estimates to keep them to the weakest grade of syrup ever served.

In making the test a dram of syrup was measured in a glass graduate, and bottle No. 4 was filled. This was always done in the morning when the bottle had been emptied by ants. A waiting Hummingbird came and took her breakfast after which the residue of syrup was poured back into the graduate, the bottle being thoroughly drained. Possibly a drop still adhered to the bottle, but the number of minims now in the graduate subtracted from sixty must have given very nearly the amount drank by the Hummingbird. In two summers a number of these tests were made. A bird took for her breakfast from eight to twenty minims, the average being fifteen. Using the low estimate of two-thirds of a

grain of sugar to each drop the average breakfast held ten grains of sugar. A better comprehension of the size of that meal may be gained by remembering that two large navy beans, or one medium-sized lima bean also weigh ten grains. Breakfast and supper were the Ruby-throats' heaviest meals, but there were many luncheons between them. By reckoning eight to nine such meals daily, (and beyond doubt there were that number), we reach again the first estimate of seventy to ninety grains of sugar as the daily ration. About this amount of sugar is held by a common tea-spoon when level full; such a spoon will hold from 110 to 120 minims of water, whereas one of those heir-looms, a grandmother's tea-spoon, is the measure of the standard tea-spoonful of sixty minims. Referring then to the standard measure the bird would be said to eat two tea-spoonfuls of sugar daily. An ordinary cube of loaf sugar contains the equivalent of this amount.

Reflecting upon the bulk consumed by so small a creature one naturally desires to know the weight of a Hummingbird. A little boy brought to us the body of a male, that had been shut into a machine shed, where its death may have resulted from starvation. Its weight was thirty-three grains. Naturalists in early days were vexed by the same question as is shown by a quotation given by Mr. Ridgway in his book on Hummingbirds. It is from "Philosophical Transactions," 1693, by Nehemiah Grew, who wrote: "I did weigh one (in those parts) as soon as ever it was kill'd whose weight was the tenth part of an Ounce *Avoirdupoise*." From these weights one makes the deduction that our Hummingbirds are accustomed to eat of sugar twice their own weight daily. If human adults ate of sugar proportional amounts there would be required nearly three hundred pounds of this saccharine food daily for the average person.

No attempt has been made to tame the birds that came to drink, yet one, perhaps two of them, became bold enough to drink when a bottle was being filled; while she thrust her bill into the empty receptacle a spoonful of syrup was fre-

quently held touching the mouth of the bottle, but she did not learn to drink from the spoon. While drinking the tongue was extended about a quarter of an inch beyond the tip of the bill, and two or three drops were sipped before the bill was withdrawn. Once fifteen drops were taken with three insertions of the bill, and at another time the bird drank without the withdrawal of her bill for about the duration of a minute. At such times the bottle was free from ants, probably they were present when the drinking was done with numerous sips. Often a bird preferred to take her breakfast in courses, perching on a nearby dead twig for a minute or two between drinks.

During two of the seasons it was thought that some of the birds roosted on our place appearing as they did very early, and making a long day for feasting and fighting. In other years the birds were seen to fly eastward at night and their morning arrivals were not so early. One June morning a bird was ready for her breakfast at four o'clock, and took her last drink at night just before the clock struck eight. On some August days there are records of their presence at break of day, in one case it was thirty-eight minutes before sunrise. They usually lingered a short time after sundown, drinking long and deeply before taking their evening departure.

The conviction that the same birds were returning to us summer after summer began to be felt at the beginning of the fourth season. On May 26 of that year the first Hummingbird appeared on the place. The next day the flowerless bottle No. 4 was put out, and in a few hours a bird was drinking from it. For the next three weeks she was seen drinking from this bottle on every day except two, but not in the middle of the day; then for two weeks she was missed, returning again on the first of July.

The history of the fifth season was similar, Hummingbirds having been seen on May 22 bottle No. 4 was staked out and filled for a few days. No bird coming to drink, the bottle-filling had been discontinued, when on June 6 a Hum-

mingbird on suspending wings was seen searching this bottle, not finding syrup in it she flew to the spot always occupied by the flower-pot holding the artificial flowers, when they were in place. Over this vacant spot she hovered an instant before flying away. On a few other June days a bird of this species was present, and on the 17th one was seen drinking, but her steady summer boarding did not begin until July 9. In the sixth spring the species arrived earlier than usual. No bottles were out on May 7 when a Hummingbird was seen hovering over the customary place for the artificial flowers. As quickly as possible these flowers were put out, but before they could be filled the bird was thrusting her bill into the tiger-lily. She came to drink on most of the days thereafter until June 9, also June 14, 15 and 24, and on July 1 and 2; but it was not until July 16 that she came for constant drinking.

These dry and dull details have been given in full because two theories were based on them. That the birds of former years have returned to be fed seems unquestionable from their searching at once flowerless bottle No. 4, and from the other evidences offered. Because the birds came in May and at intervals in June and July, before becoming steady boarders about the middle of July, seems to indicate that they nested two or three miles away, too far for daily trips after incubation began. The supposition that these nestings were in the woods is founded on the fact that in leaving the birds flew in that direction, also because they were never found about the trees of the four farm-yards that intervene between our place and the woods. That in two summers a mother Ruby-throat returned with her daughter was suggested by seeing on several occasions two birds drinking together from one bottle, a phenomenon that needs explanation when we consider the pugnacious disposition usually exhibited by one drinker toward another.

In further confirmation of the foregoing is the history of the feeding in 1913. Bottles No. 4 and No. 6 were set out on April 30. For two months and a half no Hummingbird

visited them. It chanced on July 14 that the stick support of No. 4 was lying on the ground, leaving only No. 6 in position, when my sister saw a Hummingbird thrusting her bill into it. She hastened to fill this bottle, which was the first time it had ever been filled, and it lacked but eight days of two full years since it was first set out. Six days later I was in the orchard a hundred feet or more distant from the bottles, when a Hummingbird flew toward me and buzzed about my head as do no other birds except those that are fed. With greatly accelerated pulse I hurried to the house and filled the bottles. In exactly two minutes the Hummingbird was drinking from one of them; this was the first drinking witnessed in that year. It was one of my most thrilling experiences in bird study. Two marvelously long journeys of from one to two thousand miles each had this small sprite taken since last she had drunk from the bottles, yet she had not forgotten them, nor the one that fed her. She was quite prone to remind either of us when the bottles were empty by flying about our heads, wherever she chanced to find us, whether in the yard or in the street. Once having been long neglected she nearly flew into my face as I opened the barn door to step out.

The last experiment made was that of flavoring one of the bottles of syrup with vanilla, and later with extract of lemon, to see if the birds showed preference for the plain syrup or for the flavored. Both kinds were served at the same time, and of both the birds drank, showing no choice that could be detected.

It may already have been surmised from the gender of the pronoun used that it is the female only of this species that has the "sweet tooth." Never once in the seven summers has a male Ruby-throat been seen near a bottle. The drinking birds have been examined long and critically, with binocular and without, in order to detect on some of the birds the identification marks of the young males, but without success; moreover, had young males been present they, too, would have been apt to return in later years. This absence of the

males led to noting their scarcity in general, and to recording in note-book when and where a male at any time was seen. The entire number seen in the past five years has been six on our place and six elsewhere. It is impossible to do more than estimate the number of females that have been seen; but when it is remembered that on several days in two summers seven have been in sight at one time, it does not appear to be an over-estimate to place their number at twelve or fifteen for each year, or six times more of them than of the males.

The simple experiments herein described are such that they may be tried by any one having a yard frequented by the Ruby-throat. If any one doubts that the female of this species will choose a saccharine diet, when it is available, let him continue the tests until convinced beyond cavil or a doubt. It is especially desirable that the experiments be made in proximity to the nesting birds in order to see if the mother will feed syrup to her nestlings. Sometimes our Catbirds and Brown Thrashers have come into the porch to the cat's plate and taken his bread and milk for their nestlings. Upon this hint for needed aid I have put bread soaked in milk on the fence railing for them, and they have taken it also. It is reasonable to believe that in like manner sweet benefactions proffered to a hard-working Humming-bird mother might be acceptable to her, and shared by her with her nestlings.

NEST LIFE OF THE CATBIRD.

Dumetella carolinensis Linn.

BY IRA N. GABRIELSON.

The data, on which this paper is based, was obtained from partial studies of three nests of this species during the summer of 1913. One of these was watched at Sioux City during the last two days of the nestling period. This nest will be referred to as nest A in the paper. The other two nests were located at Lake Okoboji, Iowa. One was observed by Mr.

Arthur F. Smith for the first two days of the nestling period at the end of which time the young died. The second Okoboji nest was under almost continuous observation from the time the first egg hatched until a terrific rain storm destroyed the last of the young ten days later. The nest studied by Smith will be referred to as nest B, and the other one, as nest C in this report.

During the Sioux City work, Mr. Howard Graham, Rush Gabrielson, and my wife helped with the study. As far as I am aware Mr. Smith carried on his study alone. It was intended that the last nest (nest C) be studied and reported jointly with Mr. Smith. But he was detained, by other duties, from giving as much time to the work as was planned. However, the author is under obligations to him for frequent relief in the blind, and also for permission to make use of the data obtained from the study of nest B. I wish to thank Prof. T. H. Macbride for placing at my disposal the facilities of the Iowa Lakeside Laboratory. I am under obligations to a number of the students of the Laboratory for assisting in the work in various ways. I wish finally to express my thanks to Prof. T. C. Stephens for his advice and assistance thruout the work and in the preparation of this report.

NEST LOCATION.

The Sioux City nest was discovered on June 15 and at that time contained three eggs. It was not visited again until June 28 when the young were about six days old. The nest was built in a partly broken down wahoo bush (*Evonymus atropurpureus Jacq.*) on the bank of a steep sided little ravine. The ravine was densely covered in most places by willows (*Salix sp?*), elderberry (*Sambucus canadensis* L.), and dogwood (*Cornus stolonifera* Michx.). The whole was overgrown with a tangle of vines of various species which made it almost impenetrable. Just across the fence was located a cherry orchard with blackberry and raspberry bushes between the tree rows. Nest B was discovered on June 24 in a small willow (*Salix longifolia* Mihl.) on the lake shore.

It was at the foot of a steep embankment and not more than twenty feet from the water's edge. No other vegetation was near except a few plants of *Stachys palustris* L. and *Polanisia graveolens* Raf. The nest was placed in a fork formed by four branches four or five feet from the ground. Nest C was found July 9 in a small, winding, densely wooded ravine leading back a short distance from the lake. It was placed in a small plum tree (*Prunus americana* Marsh.) which was growing in a dense thicket of wild raspberry bushes (*Rubus sp?*). The nest was built in a fork of the plum tree low enough to be covered entirely by the raspberry bushes.

In structure the three nests were practically alike. The lining was of fine roots and tendrils while the outside was of coarser material as twigs, string, and grass closely interwoven.

Nest A was discovered on June 15 and contained at that time three eggs. The blind was erected on the twenty-eighth and the nest was under observation June 30 and July 1 from 7:30 A. M. until dark. On the morning of the thirtieth the blind had been thrashed about by the wind until it required much repairing. While this was going on the parents were much excited, calling from the bushes and hopping nervously from place to place. Nest B was discovered June 24 and contained four eggs. The blind was erected June 31 at a distance of fifteen feet from the nest. On the second of July it was moved to within two feet of the nest and observations carried on the second and third. At the end of this time the nest was deserted. Nest C was discovered on July 9 and contained three eggs. On July 14 the blind was placed at a distance of thirty feet from the nest. From that point it was moved closer, daily, until on the twentieth it was five feet distant which was as close as it seemed necessary to bring it. This nest was under almost constant observation from 11:30 A. M. on the twenty-first to the evening of the thirtieth.

INCUBATION.

No data on incubation was secured in either of the first two studies and nothing very definite as to the length of the period in the last one. Nest C was found on July 9 and the first egg hatched on the twenty-first while the last one did not hatch until the morning of the twenty-second. This would make the incubation period at least twelve or thirteen days. The position the female assumed while incubating was characteristic. She came on the nest facing the blind and settled into it by a series of motions from side to side, working the feathers of the breast and belly well around the eggs. When she was down in the nest her tail stood almost perpendicular to the body and the head was well thrown back.

HATCHING.

Mr. Smith watched the hatching of one of the eggs in nest B while two out of three in nest C hatched during the time the nest was under observation. The first egg in nest B hatched before the study began but the second was observed to hatch on the morning of July 3. The other two eggs never opened as the nest was deserted on this same day. Mr. Smith says concerning the hatching of the second egg: "At 4:55 A. M. one more egg was pipped, evidently by the old bird, as it was chipped inward and directly around the center of the egg. This egg hatched at 5:55 A. M., the young bird forcing the shell open by rolling and plunging gently and by some use of the feet and wings. At 6:45 the female carried away half of the shell and returned at 6:48 with something in the bill which she swallowed, tho I could not determine whether it was the crushed shell or food. She left the nest at 6:53 only to return at 6:55 and take away the remaining shell."

In nest C the first egg was pipped at 9:00 A. M. on July 20 and at 7:00 P. M. all three were pipped in practically the same place. The first break in each shell came from within and was a little beyond the center of the egg toward the larger end. It was simply a slight bulging evidently pro-

duced by a blow from the beak of the young bird. A series of little cracks radiated in all directions from this place. The next thing noticed was the extension of a series of these bulges around the egg at right angles to the long axis. At 11:30 A. M. July 21 one egg had hatched and the shell had been removed. The two other eggs had four of these breaks extending about half way around the shell. From this time until three o'clock there was no change in appearance altho a number of times the female picked gently at the cracked places. On these occasions I could not see that she took anything away altho she undoubtedly broke the shell a little by these actions. At 3:00 P. M. she left the nest and was hardly out of sight when the egg she had been picking began to hatch. A dark line appeared around the shell and enlarged in a series of tiny jerks until I could see the young bird kicking and twisting within. The crack grew steadily wider until it was fully half an inch wide on the top of the egg, tho it had hardly opened at all on the side next the nest. At this point the female returned and immediately commenced picking at the shell membrane which still held the two pieces of shell together. As it came away a bit at a time, she swallowed it, repeating the process until the two pieces had fallen apart. She then seized the smaller piece (the big end of the egg and the one that contained the head of the nestling) and carried it away, leaving the nestling still in the remaining piece. In less than a minute she returned and seized the membrane still attached to the shell. As she pulled on the membrane, the nestling was lifted clear of the nest but fell back without injury. On the second attempt it pulled loose and tumbled the young one into the nest. The membrane was quickly swallowed and the remaining shell carried away. She returned immediately and picked the small bits of shell from the bottom of the nest, devoured them and commenced to brood. The actual process from the time the crack appeared until the last bits of shell were taken from the nest did not exceed ten minutes.

At 9:28 the next morning (July 22) the female partly rose from the nest displaying the separating halves of the last egg. The process was practically the same as that previously described. The parent again took the smaller piece of the shell first. She then returned and picked at the remaining piece two or three times and brooded for twelve minutes before any other move was made. At the end of that time she rose in the nest, picked the bird up in the shell and then let it down again. The shell then came away from the nestling and was removed, the small pieces being picked carefully from the nest as before.

In these three instances the hatching process seems to have been much the same. In each case it was due to the combined efforts of the parent and the young bird within the egg. In the first case the initial movement may have come from the female while in the last two it originated with the young. In all three the female assisted by pecking at the egg and by removing the broken shell from the nestling much sooner than it would have been able to free itself from the pieces.

In the Sioux City study the young were marked with string on the leg. One nestling A, being without any string, B with a brown string, and C, a white string. In nest B Smith marked the first one hatched with blue dye and the second one which died in a short time was not marked at all. In nest C two methods were tried. The nestlings were first marked with aniline dyes. In this way the first one hatched was marked blue, the second with brown, and the third was not marked at all by this method. The dyes did not give satisfaction as they had to be renewed several times a day to render the colors distinct to an observer in the blind altho they could be readily distinguished on a closer examination. After this method was tried, strings were fastened to the legs of the young and they will be designated as Blue, Brown, and White.

MARKING THE YOUNG.

BROODING.

The parents did no brooding during the time nest A was under observation. This study was made during the last two days of the nest life and the young birds were well feathered out. The weather was bright and warm, eliminating brooding as a protection from cold and rain and the nest was also well shaded thruout the day, likewise doing away with brooding as a protection from the direct rays of the sun. The study of nest B was too brief to obtain any data on brooding. Table I will show the time spent in brooding while nest C was under observation.

TABLE I.

BROODING TIME EACH DAY. NEST C.

Date	Brooding Time	Total Time	Per cent of Brooding
July 21.....	5 hr. 53 min.	7 hr. 35 min.	77.58
July 22.....	11 hr. 2 min.	15 hr. 50 min.	69.68
July 23.....	6 hr. 51 min.	13 hr. 40 min.	50.11
July 24.....	8 hr. 49 min.	15 hr. 30 min.	56.88
July 25.....	12 hr. 4 min.	15 hr.	80.04
July 26.....	5 hr.	14 hr. 35 min.	34.28
July 27.....	7 hr. 26 min.	15 hr. 40 min.	47.44
July 28.....	4 hr. 50 min.	15 hr. 15 min.	31.69
July 29.....	4 hr. 55 min.	15 hr. 20 min.	32.17
July 30.....	5 hr. 54 min.	14 hr. 45 min.	40.
Total	72 hr. 44 min.	143 hr. 10 min.	50.80

This table shows a tendency for the brooding time to decrease each day until it becomes about 30% of the observation time at which point it seems to reach the minimum. To warrant any conclusions in regard to this point it would be necessary to have practically the same weather and temperature conditions thruout the study. On two days, the twenty-second and twenty-fifth it rained steadily for several hours and the brooding time was proportionately increased, as the young were brooded most of this time. On the twenty-second it rained almost steadily from 11:00 A. M. to 5:20 P. M. and during this time the nest was uncovered only fourteen minutes. The absences, which were of short duration,

occurred at irregular intervals. The longest unbroken brooding period lasted for one hour and twenty minutes. Similarly on the twenty-fifth the nest was uncovered only nineteen minutes during the rain which lasted from 4:30 A. M. to 9:40 A. M. The longest brooding period on this occasion lasted three hours. Out of the total brooding time of 12 hours 4 minutes for this date, 5 hours 6 minutes were directly due to the rain. Leaving out of consideration these rainy days, the brooding time seemed to be divided into three more or less distinct periods. The first period from 4:30 A. M. to 7:30 A. M.; the second from 10:30 A. M. to 2:00 P. M.; and the third from 6:30 P. M. until dark. The first period was undoubtedly as a protection against the chill of the early morning which often made sitting in the blind uncomfortable work. During the second period the sun's rays fell directly into the nest and the brooding at this time was for protection against their heat. It was noticed that this period never commenced until the rays were falling into the nest and ceased as soon as the afternoon shadows were sufficient to completely shade it. Unbroken brooding periods for an hour or more were not uncommon at this time. The brooding in the evening was possibly merely preliminary to settling down on the nest for the night and was the most variable of the three. It commenced to become dark in the little ravine at about 6:30 and by 7:30 it was usually too dark to distinguish objects from the blind. On the twenty-ninth and thirtieth the noon period was very distinctly marked and consumed the greater part of the brooding time. On the twenty-ninth the early brooding totaled thirty-eight minutes, the noon period three hours and ten minutes, and the remainder was rather widely scattered thru the evening. On the thirtieth only twenty minutes were spent in brooding in the early morning, while four hours and fifty-four minutes were consumed at noon, and twenty minutes in the evening. The increase of the mid-day brooding on the thirtieth was due to the intense heat, local thermometers registering 100 degrees F. or more.

The position assumed in brooding depended on its purpose. In protecting the nestlings from rain or cold the positions were the same. The female settled down on the nest until it was completely covered and the feathers of the breast were well down over the young. It was also noted that she generally faced the wind. In brooding as a protection from the heat, she stood on the edge of the nest, with her back to the sun, wings spread, feathers of the breast ruffled and mouth open. From this study the brooding time seems to depend on three factors, viz.—temperature, rainfall, and age of the young. The temperature factor will of course be modified by the length of time the nest is shaded by the surrounding vegetation. As the young become older the brooding becomes less intense for heat or cold but remains about the same as a protection against rain.

FEEDING.

Few feeding records were obtained from nest B as the parents were very shy and finally deserted the nest. Altogether only six feedings were recorded and in but three of these was the food determined. In these three feedings 1 larva, 1 fly, and 1 bug were fed. The parents both approached the nest at various times with food but either ate it themselves or went away still carrying it in their beaks.

NEST A.

During the study of nest A which was under observation twenty-five hours and twenty minutes, on June 30 and July 1, 206 feedings were recorded. On twelve of these feedings two nestlings were fed making a total of 218 in which 241 morsels of food were given. The fact that the undergrowth was so dense prevented accurate determination of the sex of the parent feeding. For this reason no attempt is made to state the amount of feeding by each parent. It is known that both assisted in this work as on several occasions they came to the nest together with food.

An examination of table II reveals two interesting facts

First the great variety of food given to the nestlings and second the insignificant amount of fruit used as food considering its availibility. One cherry and nine blackberries were fed in the two days. This is about 4% or less than half the amount used by a pair of brown thrashers studied by the author[1] in the same vicinity in 1912 who fed 8.75% fruit.

TABLE II.

NESTLING FOOD FOR NEST A.

FOOD	JUNE 30	JULY 1	TOTAL
Unidentified	15	24	39
Cricket	23	12	35
Larvæ (moth and beetle)	3	4	7
Cutworms	19	3	22
Maybeetles	4	5	9
Tomato worms	3	11	14
Grasshoppers	9	5	14
Flies	3	5	8
Beetles (except maybettles)	4	13	17
Worms	8	20	28
Spiders	2	..	2
Caterpillars	4	..	4
Maybeetle larvæ	7	5	12
Butterflies	1	1	2
Katydid	1	2	3
Wireworm	1	..	1
Cankerworm	1	1	2
Centipede	2	1	3
Cabbage worm	1	1	2
Mayfly	1	3	4
Ant	..	2	2
Dragonfly	..	1	1
Blackberry	4	5	9
Cherry	..	1	1
Total	116	125	241

The remaining 96% of the food consisted of many insect forms of which the following total 116 or 48.29%:—maybeetles and larvae, cutworms, flies, crickets, grasshoppers,

[1] Proceedings of Iowa Academy of Science for 1913.

cabbage worms, and tomato worms or some closely related species. This list includes many of the most troublesome and injurious insect pests in this vicinity during the summer and any species of bird which aids in their destruction must be beneficial to some extent. The parent birds were not noted eating the cherries or blackberries themselves altho a few were fed to the young.

NEST C.

The study of nest C which was under observation for 143 hours and 10 minutes, yielded 517 feeding records. On 51 of these visits two nestlings were fed making 568 feedings during which 596 morsels were fed. There was certainly no regurgitative feeding in this instance as two of the nestlings were under observation from the time they hatched. At 11:55 A. M., July, 21, the female approached with a measuring worm an inch long and tried several times to give it to Blue. When after numerous attempts he could not swallow it, she devoured it herself. The first food Blue was observed to get was a smaller measuring worm, and the next, a small beetle. Brown hatched at 3:07 P. M. and in just an hour received a measuring worm, followed by a fly. White was given a mayfly as his first food. Many times during the first few days of feeding the female brought grasshoppers and worms too large for the young to swallow. The method of procedure in such a case was always the same. Each nestling was tried several times and if the morsel was not then taken it was swallowed by the parent. The female did all the work in caring for the brood while the nest was under observation. This included all the daylight hours from the hatching of the first egg until the feeding activities were over, with the exception of about four hours. The male was noted several times each day, singing and foraging in the near by shrubs. Twice he approached the nest with food but did not feed the young.

From the beginning of the study Blue, who was at least five hours older than Brown and twenty-two hours older

than White, was favored in the feeding. At every approach of the parent bird with food, he would climb over the other two, and, by reaching further up than they, succeed in getting most of the food. From the first day, all three nestlings raised their opened beaks at any slight noise or jarring of the nest. With Blue getting most of the food it was only a question of time before the other two would perish. Brown was the first to succumb. He was fed at 4:35 A. M. on July 24 but from that time was totally ignored. For a time he would raise his head, open his mouth, and give the peculiar coaxing call many young birds use, but gradually he grew so weak that this was impossible. He soon lay on the bottom of the nest under the others and died before noon. The body was still in the nest at dark but had been removed by 4:30 the next morning. It may have been removed at night but it is more probable that it was done before the observer entered the blind that morning. From noon on the twenty-fifth, White was noted to be getting less and less of the food. Blue was at least twice the size of White and, on every approach of the parent, would stretch far up out of the nest with loud cries, at times completely covering him. As Blue received more of the food he became more able to trample over White and crowd him out of place. If White did succeed in getting a favorable position, Blue, on the appearance of the female, would climb over him pushing him into the bottom of the nest. On the twenty-seventh he was fed only twice: once, at 5:00 in the morning; once, at 7:11 P. M. On the morning of the twenty-eighth an unsuccessful attempt was made to force the feeding of White by removing Blue from the nest. The female immediately tried to feed him but brought insects too large to be swallowed. Blue was finally replaced in the nest and instantly commenced to appropriate all the food as before. White gradually weakened and by 9:30 was dead. The body remained in the nest until 4:25 P. M. when the parent seized it by the posterior end and flew away with it. Blue was fed up to the evening of the thirtieth and was just about ready to leave the nest at that

time. The blind was closed at 7:30 with the female on the nest. During the night a terrific rain and wind storm occurred, and when I entered the blind the next morning at 5:00 the female was on the nest but it was wet thru and Blue was dead.

The death of the nestlings thru the feeding period and the lack of assistance by the male accounts for the much lower number of feedings as compared with the brown thrasher studied in the same vicinity in 1911[1] and the yellow warbler as reported by Bigglestone.[2] The brown thrasher made 775 visits in 56 hours, the yellow warbler 2373 in 144 hours and 53 minutes, and the catbird only 517 in 143 hours and 10 minutes. This total does not include visits where food was brought to the nest and then devoured by the parent.

The distribution of feedings thru the various days was as follows: July twenty-first, 10 feedings; twenty-second, 35 feedings; twenty-third, 38 feedings; twenty-fourth, 57 feedings; twenty-fifth, 39 feedings; twenty-sixth, 71 feedings; twenty-seventh, 55 feedings; twenty-eighth, 64 feedings; twenty-ninth, 96 feedings; and the thirtieth, 51 feedings. It will be noted from this data, that the daily number of feedings shows a tendency to increase. This is disturbed by three factors. First, after the death of each one of the two young, Brown on the twenty-fourth and the twenty-sixth when White ceased to receive food, there is a decided drop in the number of feedings. Second, on the twenty-fifth, one of the rainy days, the number of feedings is lowered. The other rainy day, the twenty-second, came too close to the beginning of the study to make it possible to say how much the number of feedings was affected. On these rainy days the female was almost constantly brooding during the storm and consequently the time for hunting was much shortened.

[1] A Study of the Home Life of the Brown Thrasher. (*Toxostoma Rufum* Linn.), by Ira N. Gabrielson. Wilson Bulletin, Vol. XXIV, June, 1912.

[2] A Study of the Nesting Behavior of the Yellow Warbler. (*Dendroica a. æstiva*), by Harry C. Bigglestone. Wilson Bulletin, Vol. XXV, June, 1913.

Third, the extreme heat of the thirtieth seemed to make the parent very sluggish as she did practically nothing but sit in the bushes during the greater part of the day. During the first two days of the feeding activity, the female gave a soft call as she approached the nest with food. At this call every head came up. At the end of the second day this call was practically discontinued and the nestlings had learned to detect her approach by the shaking of the bushes.

TABLE III.

FOOD GIVEN TO NESTLINGS IN NEST C.

INSECTS FED	21	22	23	24	25	26	27	28	29	30	Totals
Unidentified	3	4	21	20	12	11	17	27	29	17	161
Measuring worms..	3	4	3	3	2	1	1	3	..	1	21
Beetles	1	1	2	16	..	16	2	1	8	8	55
Flies	1	11	6	7	26	26	5	8	8	1	99
Larvæ	2	4	3	5	5	10	5	2	9	7	52
Mayflies	..	5	5	3	5	2	6	1	13	2	42
Moths	..	8	3	..	2	6	7	3	4	7	35
Grasshoppers	..	2	2	6	..	6	6	7	10	1	40
Wireworms	..	2	..	..	..	..	..	3	..	..	5
Katydids	..	..	1	1	..	2	1	1	3	..	9
Worms, var. sp.....	..	..	1	2	2	4	2	3	4	3	21
Spiders	..	..	1	..	..	2	..	2	7	5	17
Dragonfly	..	..	..	1	..	1	2	2	..	..	6
Caterpillar	..	..	..	..	1	..	3	1	3	..	8
Mosquito	..	..	..	..	..	1	..	..	..	..	1
Butterfly	..	..	..	..	..	1	1	..	..	1	3
Cricket	..	..	..	..	..	..	2	3	5	1	11
Raspberry	..	..	..	..	..	..	..	..	7	1	8
Small frog?.....	..	..	..	..	..	..	..	..	..	1	1
Gooseberry	..	..	..	..	..	..	..	..	..	1	1
Total	10	36	48	64	55	89	60	67	111	56	596

Under table III the unidentified includes those insects so small they could not be identified with certainty, those unknown to the person in the blind, and those so badly mangled as to be unrecognized. All of the beetles were put in one class as the number of each species was very small. Among the 55 beetles fed were recognized may-beetles, click beetles,

tiger beetles, water beetles, and snout beetles of various species. The flies were mostly fish flies tho house and stable flies were also noted. On one occasion a small frog was thot to have been fed. On the last two days of the study, wild raspberries and gooseberries were fed in small numbers. Under the title "larvae" is included all moth and beetle larvae. A few cutworms and may-beetle larvae were among them. Of all the insects used as food, flies were the most easily obtained. These and the grasshoppers were the two most conspicuous forms in the little ravine in which the nest was located. The flies were to be seen in large swarms over the bushes and the grass contained numbers of grasshoppers.

Of the 596 morsels fed, 99 or 16.61% were flies; 40 or 6.71% were grasshoppers; 142 or 23.82% were beetles, moths and their larvae; and 9 or 1.51% fruit (raspberries and gooseberries). The remaining 51.35% was made up of various insect forms in small numbers. The fruit consumed is not of any economic importance as it was all wild fruit. It is important only as further proof of the feeding of fruit to the nestlings when it is available. Deducting this 1.51%, we find that 47.14% of the nestling food in this case was composed of flies, grasshoppers, beetles, and moths, practically all of them injurious.

The most significant fact of the two studies is the great variety of insect species used as food. From these and other studies, the conclusion is drawn that the most available supply of food is largely used. Both of these little ravines teemed with insect life and as a result no one or two species stand out prominently as the source of food supply. In the study of nest C, flies were noted to be exceedingly plentiful among the bushes and many times were caught from the nest or near it but other insects were also numerous and flies do not furnish any unusual part of the food. In the case of the brown thrasher previously mentioned, it was found that grasshoppers, moths, mayflies, and cutworms totaled 1012 out of 1260 morsels fed or 80.31%. This was undoubtedly due to location. The nest was on a dry hillside with only a few scat-

tered trees and the insect forms to be found in any numbers were limited to the forms mentioned. The yellow warbler nest was located in the same kind of a ravine as the catbird nest C and the variety of insects was great, as is shown by the report. It would seem then, that the accident of location has considerable influence on the character of the food given to the nestlings. For example, location in a position representing a variety of conditions of vegetation, shade, soil, and moisture will cause a wide variety of insect species to be fed. On the other hand, a situation presenting few of these variations will limit the number of species fed and will very probably cause one or two forms to furnish a large percentage of the food. The surrounding area need not be large to furnish these conditions as all the birds yet studied seem to forage within a comparatively small area around the nest.

DISTRIBUTION OF THE FOOD TO THE NESTLINGS.

In nest A, nestling A who had left the nest at 11:16 A. M. on July 1 received 47 feedings while B and C who stayed until night received 83, and 88 feedings, respectively. Up to the time A left, B had received 41 feedings and C 60 to A's 47, or an average of 49 to each nestling. No regularity was noted in the feeding, the same one being fed three or four times in succession during some periods.

During the study of nest C, the distribution of the food to the nestlings was interrupted by the death of two out of the three nestlings while the nest was under observation. Table IV shows something of the distribution of the feedings and food during the ten days.

TABLE IV.

SHOWING THE DISTRIBUTION OF FEEDINGS IN NEST C.

DATE	UNDETERMINED	BLUE	BROWN	WHITE	TOTAL
July 21.....	..	6	6	..	12*
July 22.....	7	16	14	3	40*
July 23.....	10	18	13	12	53*
July 24.....	2	40	1	24	67*
July 25.....	5	29	..	13	47*

July 26.....	1	54	..	27	82*
July 27.....	1	53	..	2	56*
July 28.....	..	64	..	..	64
July 29.....	..	96	..	..	96
July 30.....	..	51	..	..	51
Totals	26	427	34	81	568

* On some feedings two of the nestlings were fed.

As shown by the table, Blue received an unequal share of the food almost from the first. This share increased rapidly until the death of White, after which, he of course received all of it. This is probably not an unusual happening in the bird world altho not often witnessed. From the studies already mentioned and from others whose results have not been published, it seems that the distribution of the food is governed to a considerable extent by the strength of the nestling rather than by the exercise of any instinct or judgment of the parent feeding,—that is the nestling which is able to make the greater outcry and also make himself the most conspicuous almost invariably receives the food. This fact stood out most markedly in the study of nest C but has also been noted in other studies. On the other hand if the nestlings were nearly equal in strength the food would be more equally distributed. With both parents feeding this factor might not operate rigorously enough to cause the death of any nestling, on account of the more abundant food supply. It did not appear in this case, that the male was kept away from the nest by fear of the blind, as he was continually noted in the bushes near by and one of his favorite perches while singing was a spot in the raspberry bushes much closer to the blind than was the nest. His action must have been due to some unknown factor as the male catbird, does in some instances, at least, assist in the feeding process.

SANITATION.

In the sanitation of the nest the catbirds, were in all the studies, found to be scrupulously clean. Not only was the

excreta rarely allowed to touch the nest but the parents were continually picking parasites from it and the young. On several occasions the female in nest C probed vigorously in the bottom until the nest and the tree in which it was located vibrated violently. The shells, even to the smallest piece, were carefully removed.

From nest A, the excreta was removed 73 times while it was under observation. 67 sacs were removed from the bird last fed. The excreta was devoured 54 times and carried away 19 times. The place of depositing the sacs was not discovered, as it was impossible to follow the movements of the parents in the dense shrubbery. On one occasion while both parents were at the nest, one of them took a sac from one of the young and started to devour it. The other parent seized it and tried to pull it from the first one. After several vigorous jerks the sac broke and each one devoured the piece retained.

In nest C, as in A, the excreta was rarely allowed to touch the nest but was taken directly from the young. During this study the excreta was removed 125 times, 88 times from the nestling last fed, 20 times from some other one and in 17 instances it was not determined.

TABLE V.

SHOWING METHOD OF EXCRETA DISPOSAL. NEST C.

DATE	DEVOURED	CARRIED AWAY	TOTAL
July 21.....	3	..	3
July 22.....	20	..	20
July 23.....	16	..	16
July 24.....	20	..	20
July 25.....	12	..	12
July 26.....	13	4	17
July 27.....	4	6	10
July 28.....	4	8	12
July 29.....	1	9	10
July 30.....	2	3	5
Total	95	30	125

Table V shows that up to the sixth day the excreta was always devoured. From this day part of it was devoured and the remainder carried away. The proportion carried away, increased to the end of the study. When carried away, it was usually taken across the ravine and out of sight among the trees. Occasionally it was taken around the blind and carried toward the head of the ravine. In either case we failed to get any data as to the final disposition.

MISCELLANEOUS BEHAVIOR AND INCIDENTS.

On approaching and leaving the nest, the behavior was fairly constant. There seemed to be, in nest A, little variation in the method of coming to the nest and both parents used the same path. They always came in sight at a certain point in the undergrowth and then came by hopping from one branch to another. Much of the time they used the same branches. In leaving a variation was noted altho in the majority of visits they returned over the same route as they approached. At other times they flew directly toward the blind from the nest and then either passed over or flew around it. In nest C the method of approach was less stereotyped. During the first five days one method was used but from that time others were used, altho the first one continued to be the favorite. The first method was to fly to the raspberry bushes at a point directly opposite the blind and come to the nest by hopping from branch to branch. The second method, and the one least used, was to fly directly to the nest, alighting on the edge next to the blind. The last method was to fly to one of the guy ropes of the blind and hop from there to the nest over the tops of the bushes. In leaving, the same three paths were followed, the first one being generally used.

The difference in the behavior of the catbirds toward the blind made an interesting study. At nest A the parents never exhibited any marked fear of the blind, even while it was being erected, but stayed in the bushes two or three yards away hopping nervously about and scolding harshly. After the blind was erected they soon became used to its

presence and used the guy ropes as perches. The blind was placed very close to nest B and may have had more effect on the parents for that reason. At any rate they became more timid and shy each day and finally deserted the nest. At nest C the female scarcely paid any attention to the blind while it was being erected or afterwards. Persons could pass in and out at any time and conversation in loud tones could be carried on in the blind without disturbing her in the least. She would hardly leave the nest long enough for us to mark the young and then generally sat a few feet away and watched proceedings without making any fuss. At one time during the study a platform was built inside the blind to level the floor. The sawing and hammering necessary to do this did not cause her to leave the nest. The male apparently paid little attention to it as he hunted right up to the edge and many times sat on the bushes within two or three feet of it while singing.

In this connection, I recently received some interesting notes from Mr. Harry C. Bigglestone regarding an attempt to study a catbird nest in 1912, and with his permission I will introduce them here. " * * * From my observations, the old birds would not feed when any one was in the blind. They would remain in the vicinity and call but would not approach the nest. I would sit in the corner out of sight of the nest and watch closely but never saw the old bird feeding. The young at times became nearly frozen and starved to death, so I would leave and sit in a path forty or fifty feet from the nest watching from there. The old birds soon started feeding but stopped again as soon as the blind was entered. This was repeated several times and always with the same results. After attempting observations for two days and the plan of staying even at intervals thruout the day had proven unsuccessful, the blind was removed." These instances show the amount of individual variation noted in the different pairs.

Nest C seemed to be quite a curiosity to the birds of the vicinity judging by the number of visitors it had. A king-

bird, brown thrasher, and yellow warbler. each came once and looked into the nest. The female paid no attention to the kingbird or warbler but was somewhat disturbed by the thrasher. Blue jays frequently came into the neighborhood and on these visits the catbird's actions were always the same. If she happened to be away from the nest, she flew to some perch from which she could watch both the nest and the jays, and remained there until they left. Her favorite perch at these times was the dead branch of an ash tree about thirty feet from the nest. If she were on the nest when they appeared, she merely settled down and remained motionless until they left. A flicker came blundering into the blind two or three times and hopped on the platform in pursuit of ants. Once he approached within a foot of my chair before he noticed me and flew out with a squawk of fright.

Of all the visitors, a house wren furnished the most amusement to those in the blind. Several times every day, he hopped to the edge of the catbird's nest and sat there inspecting it for some time, turning his head first on one side and then on the other. When the catbird appeared, he would fly around the blind. This particular wren seemed devoid of fear, as he entered the blind one or more times each day either thru the ventilator or the opening at the back of the blind. Twice he flew into the observation opening within six inches of my face to get away from the nest at the approach of the catbird. Usually she paid little attention to him, but twice flew at him and drove him away.

A chipmunk at one time climbed into a little plum tree next to the nest, during the absence of the catbird. On her return she flew at him with such violence as to knock him from the tree to the ground. On one occasion a cat, and on another a dog, passed thru the ravine near the nest. Both times she remained on the nest but was unmistakably uneasy as long as they remained in that vicinity.

The departure of only one of the nestlings was observed and that was nestling A from the Sioux City nest. His de-

parture was accomplished very simply. At about 11:15 A. M. he climbed to the edge of the nest and attempted to jump to a twig a short distance away. He fell short and tumbled to the ground without injury. At this time the parents appeared and coaxed him off into the thick underbrush in the ravine. The next morning both of the others were gone from the nest. In nests B and C the young all died before they were old enough to leave.

Marshalltown, Iowa.

BIRD NOTES FROM THE SOUTH-WEST.

BY J. L. SLOANAKER

It was with no little delight at the thought of new friends to be made in a new bird-world, that the writer prepared to leave his home in central Iowa during the intensely cold weather of middle January, 1912, and seek the warm sun and dry cactus covered sands of southern Arizona. Tucson, the metropolis of Arizona, and situated only 70 miles from the Mexican line, was our goal; and the period from January 25 to April 25 — the Arizona springtime — our stay.

Bird lovers who are wont to travel occasionally, especially those who come from the East and go into the far West or South, are indeed treated to a wealth of strange sights and new forms in the scientific world, pleasures which are not vouchsafed those who must remain in their home bird-world, but which, fortunately, can be partially enjoyed through the recorded experience of others. Stories concerning the great South-west had always intensely interested us, and we departed with a resolution not to permit other duties to rob us of the time necessary to experience as much as possible. And although there is more recorded information from Tucson than from any other part of the South-west we present our notes herewith, hoping that we may add something of interest.

By the 20th of January we were off and away, eagerly

scanning the stretches of new country which unfolded themselves as the train proceeded and straining our eyes, already half blinded by the dazzling snow, to catch a glimpse of any new bird that might be within range. Our interest was soon rewarded by the sight of numerous birds that in this day rarely breed in central Iowa, although rather common during certain winters, namely, the Prairie Chicken (*Tympanuchus americanus americanus*), most of which have probably gone to help decrease (?) the cost of living. Our railroad followed a creek and then a river, through a country composed of woodland and cornfields, and at almost every siding corn was being loaded into cars. Here there was much waste of corn on the ground, and after the train and wagons had departed, the "chickens" flew up to feast. One small tree in the edge of a pasture and the ground underneath was black with the birds, and from the great numbers seen we concluded that they were present in the greatest numbers in recent years.[1]

In the Centerville, Iowa, district, and from thence southwest to Kansas City the Rock Island takes us through a country underlaid with coal and chopped by deep, wooded ravines, an ideal country for hawks and owls. We wished that we could tarry a while to hunt them up, but the train rushed on as we dreamed of the rare finds we might have made could we have stopped there. Early the next day we were at Hutchinson, Kansas, noted for its saltworks, as is also Salina (hence the name). As we rushed onward we dreamed again, this time of the ancient days in Kansas when its billowy surface was the bed of an inland sea, where lived *Hesperornis* and others of its kind, in a world of their own, only recently (1873) made known to man. How we wished that we could take a side trip to the University museum to "view the remains"! The rest of the day, as we traversed the lonely plains of the Texas Panhandle, we were delighted and saddened in turn as we attempted to identify the hundreds of hawks circling about, low down, when disturbed

[1] More fully discussed in Wilson Bulletin No. 78.

and frightened from their feast — the equally numerous dead bodies of cattle that had perished in the recent blizzard. We closed our eyes upon the dismal scene, thankful that the approaching darkness would soon completely hide it, and that the night's travel would reveal to us a new country, the borderland of summer.

As if to welcome us, as we alighted from the train next morning to stretch our legs in the station yard at El Paso, the friendly though wary Ravens came sailing about, carefully watching the back door of the nearby restaurant with one eye, while with the other they followed the porters carrying supplies to the diner. Always looking for a "scrap"! So we tossed them one from the remains of our lunch and tried to make friends with them, but can only report that Mr. Raven is a very cautious gentleman, speaking his greetings from a distance. Good natured, though, for he accompanied us clear to Tucson, never being out of sight, and aside from the ever-present meadowlarks and blackbirds, the only new bird that we could safely add to our list, in that long stretch of country.

Our goal at last! We could hardly sleep last night, for to-day we will be afield, taking in the sights of "Queen City of Cactusland," and investigating the bird-life of the region. Violets and narcissus are blooming and the cottonwood buds bursting. We are bewildered by the wealth of bird life, and after listing a dozen species new to us and easily recognized, as well as the descriptions of a dozen others — puzzlers — we decided to wend our way to the University Museum, close at hand, for a season of study. Here we found the exhibit of birds second only to that of the Ores, and although mostly collected in 1885-'89 these bird skins are as clean and beautiful as if placed there only yesterday. All this was the work of the genial Mr. Herbert Brown,[1] the pioneer naturalist of that region, who, when we found him (he is a busy man) was most eager to assist us and explain our puzzles. Then

[1] Since deceased.

we unpacked our reference literature,[1] and the preliminary thrills over, were ready for business.

We found Tucson spread over a plain of about 2300 feet altitude, arid and cactus grown, except near the river (so-called!), and vicinity of artificial ponds and ditches. The surrounding mountains with their different zones of life from base to summit, widened the field of exploration for us. The city is in the lower Sonora zone. Creosote bushes abound in every vacant lot in town as well as covering all the adjacent country; the smaller cacti flourish as well, while at a distance are the mesquite groves, live oaks and giant cactus.[2]

The White-necked Ravens, as before, were the first birds to attract attention;[3] to an easterner they strike one as half a crow in size and voice, though not in speed of flight, and as they are protected by law, being valuable scavengers, are abundant and tame. We looked in vain for their white necks, but as the feathers of the neck are white at the base only, this could not be seen except when the wind was blowing hard.

In the afternoon, when hunger has been satisfied, a dozen or more go for a "social sail" high in the air. No trapeze man in a parachute ever performed such amazing feats as these jolly birds, chasing each other, dropping scores of feet with closed wings, turning on their backs with feet up, and even rolling completely over like a barrel, all the time laugh-

[1] Available literature necessary for the sojourner at Tucson:
Handbook of Birds of the Western U. S.—Bailey.
List of Southern Arizona Birds.—W. E. D. Scott and Herbert Brown. Found in Introduction of the Handbook.
Notes on the Birds of Pima Co., Arizona.—S. S. Visher. From the Auk, Vol. 27, No. 3. July, 1910.
File of the Condor, as complete as possible. Important specific references are:
Summer Birds of the Papago Indian Reservation, near Tucson, by H. S. Swarth, Condor, Vol. 7, Nos. 1, 2 and 3. Jan.-June, 1905.
Articles descriptive of Nesting Species, by F. C. Willard.

[2] See Habitat Group of Desert Bird-life. Opp. page 168. Vol. 9, Bird-Lore.

[3] This and the following four sketches reprinted from the Newton (Iowa) Daily Journal, March, 1912. The descriptions are adapted from Bailey's Handbook.

ing and chuckling — "cutting their teeth "— we called it, to each other.

When the sun strikes their glossy black plumage just right it is turned to white satin for an instant. After they become tired of their sport they descend for an evening lunch, and finally all go to roost in the cottonwood trees growing on the campus. A pretty picture, indeed, to see the setting sun lighting up these huge, white-limbed trees, studded with their families of black ghosts!

Next in interest to an Easterner come the Arizona *Pyrrhuloxias*. This peculiar name comes from the Greek and means flame-colored. They are relatives of the eastern grosbeaks and look like small parrots with their short, thick, yellow bills and raised crests. The face, throat, breast, thighs and lining of wings are a light rose red; the other parts a mellow gray color. Such a wonderful combination of colors, the exquisite rose-colored shirt front lighting up the soft gray coat, as the big yellow bill and raised crest thrown forward is seen coming towards you through the green, lace-like leaves of a creosote bush or pepper tree![1]

Next come the little vermilion flycatchers,[2] typical Mexican birds, and real gems for color. They look just like the small editions of the scarlet tanager, except for their crests; and they dart out from perches on the bushes to catch insects on the wing, just as the phœbes do. Would that we could persuade them to migrate to the north, where we could enjoy them occasionally, as we do the scarlet tanagers[3] and cardinals.[4] Scarlet, vermilion, cardinal, — what a display of shades! Could you tell them apart?

Of all the birds on our list the Roadrunner is doubtless the most unique; indeed, he is *queer*, and would certainly take first prize in the freak class at the Arizona state fair. He is about two feet in length, with a tail as long as his body, color

[2] Colored Illustration opp. page 241, Vol. 9, Bird-Lore.

[1] See Illustration facing page 371, Handbook of Birds of Western U. S.—Bailey.

[3] Colored Illustration opp. page 147, Vol. 8, Bird-Lore.

[4] Opp. pg. 39, Vol. 8, Bird-Lore.

above brown streaked with black, bare space around eyes blue and orange, feathers of head and neck bristle-tipped, eyelids lashed, crest a glossy, bronzy green, with white thumb marks on his tail, — his whole plumage coarse and harsh Could you imagine such a looking creature? Try and think of a long striped snake on two legs, a feather duster on his head and another trailing behind; or a tall, slim tramp in a swallow-tailed coat, a black-and-blue eye, and a head of hair standing on end! There you are! All equally ridiculous looking.

To see our feathered what-is-it you must go to the high, dusty foothills as a rule, although he sometimes strays down into the suburbs. If you are driving he will run along down the road ahead of you, keeping ahead no matter how fast you drive. It is said he can outrun the swiftest horse. He belongs to the cuckoo family and is sometimes called ground cuckoo, lizard bird, or a chaparral cock; the Mexicans call him "little friend." As to diet, he eats mice, lizards, crickets, centipedes, crabs, snails, garter snakes and cactus fruit,— most any old thing. Perhaps this strange menu accounts for his looks!

Of Quails,[1] Arizona boasts four different species: the Masked Bob-white, so called because its face and throat are black; the Scaled Quail, whose bluish-gray feathers resemble scales; Gambel's Quail, the common valley quail of the west; and the Mearns Quail,[2] the United States form of the Massena Quail of Mexico. This is indeed a most striking quartet as you see them beautifully mounted in the University Museum; all of the greatest beauty of plumage, the Mearns being in addition quite odd looking. Its face is striped with black and white, its body is stubby and plump, the under parts dark brown, spotted with large, round white spots. Instead of raising its crest in the usual way it is said to spread it out laterally like half a mushroom. The Gambel and Scaled Quails can be found near the city, the others are found only

[1] See figures opp. pages 118 and 122, Bailey's Handbook and American Ornithology, Vol. 2, No. 1, Vol. 4, No. 1.
[2] See Condor, Vol. XI., pg. 39.

in the neighboring high mountains, where also, if one is fortunate, he may get a Wild Turkey.

Next in interest comes the doves, of which Arizona has five species. The Inca Dove is the most common, treading daintily along gravel paths, across front yards, barn yards, and often seen among chickens in the coop. As early as February 25 some were sitting upon their two pearl-like eggs in the pepper trees, while others were only selecting their brides, scrapping and fighting over them in the most undove-like fashion, batting each other with their salmon lined wings, and "pulling each other's hair," or rather feathers, with their small, sharp beaks. The feathers of this bird, especially when ruffled, are so arranged as to suggest scales. The Mexican Ground Doves are the smallest of all doves, really only half a dove in size, resembling nestling "turtle" doves. You might mistake one for a large gray mouse as it patters about on the ground hunting seeds; indeed they are so small and dear that you wish you could carry one about with you as a sort of living watch charm!

The White-winged Doves, — the Sonora doves of the natives — frequent the mesquite groves near water, where large flocks will gather to drink at evening, and where many meet their fate at the hands of the Mexicans and local "sportsmen."[1] The Band-tailed Pigeon is a large dove of general

[1] See Vol. 12, page 275, Bird-Lore.

distribution in the west, where they live in the oak regions of the mountains, feasting upon acorns and wild berries. The Mourning Dove, with which we are all familiar, completes the quintet.

There is no complete, up-to-date list of the Birds of Arizona. Scott's list, published in the Auk in 1886-'88, is good as far as it goes. It lists the birds of three counties in southern Arizona, mentioning some 230 species. Visher (Auk 27: No. 3) adds thirty new species to that and gives fuller notes on many others. This briefly annotated list purports to bring Scott's list down to date. Swarth, in the Condor (Vol. 7, Nos. 1, 2, and 3), has given us a valuable and com-

plete local list of the summer birds of the Papago Indian Reservation near Tucson. Notes from the great stretches of country comprising the northern part of the state are fragmentary or lacking.

The following brief notes are offered supplementary to the above. They cover the three months from January 25 to April 25, 1912, and were made mostly in the north part of town or upon the plains one mile to the north. Mrs. James Wheeler, who resides two miles northeast of Tucson, has done considerable hunting among the water birds and has also mounted quite a few of them. I had the pleasure of examining them and am indebted to her for data concerning same. The fact that the writer was supposed to be an "invalid" explains the brevity of the notes. Thirty skins were made up and properly identified. The other forty species observed furnished data identical with what has been already published.

By February 20 the fruit trees were in bloom and the cottonwoods had small leaves. Gnats became numerous and attracted thousands of Ruby-crowned Kinglets, gnatcatchers and warblers. On February 23 we had a hard dust storm, which confused the migrating hosts greatly, and prohibited food-getting for most of the day. Consequently the birds were up late and were heard beating around the buildings all that night. It rained the rest of the night, but as the morning was warm and clear, the hosts were out early, fairly swarming everywhere. Brewer's Sparrows were extremely common and next in abundance to the Blackbirds. The first small lizard came on March 1st, and the cricket chorus thereafter resounded nightly. March 9th it stormed in the mountains and I took a much-bedraggled female Cedar Waxwing that evening. March 12th we had a hard rain, which later turned to snow. From the custom of scratching their heads it was evident that the birds were either puzzled over the weather or else assisting the molting process. March 30 we had another rain, and a snow in the mountains. I searched the north part of town carefully for more Waxwings, but

was unsuccessful in finding any. April 1st the cottonwoods were in full bloom and many of the trees infested with the larva of some moth, so much so as to completely defoliate the trees. Although I watched carefully, not one of the thousands of migrating birds were seen to eat the larva, although the abundant House Finches often picked the seeds from the "cotton."

Pelecanus erythrorhynchos.—White Pelican.

Three shot by local hunters March 29th.

Marila affinis.—Lesser Scaup Duck.

Common March 16th in the Santa Cruz reservoir. So tame that one could row among them.

Clangula clangula americana.—Golden-eye.

Recorded as new species for the state. Condor, XIV; 154.

Erismatura jamaicensis.—Ruddy Duck.

Juvenile mounted by Mrs. Wheeler, March 16th.

Grus canadensis.—Little Brown Crane.

Recorded by myself as new to the state. Condor, XIV; 154.

Steganopus tricolor.—Wilson's Phalarope.

Several mounted April 7th by Mrs. Wheeler.

Recurvirostra americana.—Avocet.

Found common October 12, 1911, by Mrs. Wheeler.

Numenius americanus.—Long-billed Curlew.

Taken October 12, 1911, by Mrs. Wheeler.

Callipepla squamata squamata.—Scaled Quail.

Found common at Oracle, elevation 4500 feet on west slope of Catalinas, by Mrs. Wheeler.

Scardafella inca.—Inca Dove.

Abundant about the streets of Tucson, while not a specimen of *Chaemepelia passerina pallescens* was seen during my stay. Mr. Willard reports the opposite from Tombstone; viz. that the Inca Dove does not nest there, while the Ground Dove is common.

February 25—Nest building; first eggs found.

March 10—A nest with large young.

April 10—Many other doves just starting to build.

Cathartes aura septentrionalis.—Turkey Vulture.

First seen February 1, soaring high. Next seen March 20; then April 10, after which they became common. We were told by several different parties that "when the vultures come they drive the ravens away."!

Falco columbarius columbarius.—Pigeon Hawk.

One seen darting through the bushes of the campus February 18.

Buteo borealis calurus.—Western Red-tail.

Quite common during our whole stay, beating over the plains. I prepared two skins, one a mature male in the dark chocolate plumage, and the other an immature male, light phase. These had been shot by boys. The stomach of the first contained a squirrel, which had been beheaded, neatly "quartered" and taken in five swallows as follows: four entire legs, to one of which the skin hung, and the viscera in a ball. The feet and roof of mouth of both hawks were full of cactus spines.

Sphyrapcus thryoidens.—Williamson's Sapsucker.

One seen March 3 on the campus.

Chordeiles acutipennis texensis.—Texas Nighthawk.

Seen only once, March 17th.

Æronautes melanoleucus.—White-throated Swift.

Common everywhere during April.

———— ————.—Hummingbird.

One seen February 14, had large, white patch on side of head, easily seen from a distance of forty feet. I thought the gorget to be purple, but only had one flashing glance at it. Upper parts green. It was evidently either a young male Broad-billed Hummingbird (*Iache latirostris*) or adult male White-eared (*Basilinna leucotis*), in either case, a rare seasonal record for that altitude. Although the writer is unacquainted with Hummingbirds in general, the description fits the above two birds only, with evidence in favor of the latter; the evidence, however, is given for what it is worth.

Pyrocephalus rubinus mexicanus.—Vermilion Flycatcher.

Common everywhere during our stay, the young males molting and consequently beautifully blotched with vermilion. See migration report, Bird-Lore IX., 265.

Nucifraga columbiana.—Clarke's Nutcracker.

Mr. Willard has always found them to be very rare in the high mountains. Mr. Lusk, through Mr. Visher, reported them "occasionally abundant."

Molothrus ater obscurus.—Dwarf Cowbird.

First seen February 18. Mr. Visher reported May 5.

Agelaius phœniceus sonoriensis.—Sonora Red-wing.

Two specimens I took were identified by Mr. J. Grinnell. Thousands of "blackbirds" nested in the bushes and trees in town each night, and I know of at least one man who regularly frightened them away with a shotgun on account of their noise and filth.

Icterus cucullatus nelsoni.—Arizona Hooded Oriole.

Arrived March 21.

Icterus bullocki.—Bullock's Oriole.

Arrived March 23.

Carpodacus mexicanus frontalis.—House Finch.

Their sweet warbling song heard from dawn until dark. February 9, commencing to build. March 20, birds setting everywhere, nests built about porches, on meters, and in cacti. April 6, nest with young about half grown.

Poœcetes gramineus confinis.—Western Vesper Sparrow.

First migrants arrived March 3.

Zonotrichia leucophrys gambeli.—Gambel's Sparrow.

Abundant everywhere, the young more common than the adults. Specimens taken after March 1 were molting on head, neck and legs. They gleaned the ground grain from the chicken coops and picked the leaf tips from the privet hedges for a relish.

Melospiza melodia montana.—Mountain Song Sparrow.

Noted February 21 and March 17 along the river. But a careful lookout failed to reveal *M. m. fallax* at any time.

Melospiza lincolni lincolni.—Lincoln's Sparrow.

Quite common during our stay, up till April 10. Four skins were taken February 20.

Cardinalis cardinalis superbus.—Arizona Cardinal.

Occasionally seen in the underbrush along the river; only noticed three males in town during the period.

Passerina amœna.—Lazuli Bunting.

One seen April 15, near San Xavier Mission.

Calamospiza melanocorys.—Lark Bunting.

Abundant in large flocks. The young molting males were handsomely blotched with black and white.

Bombycilla cedrorum.—Cedar Waxwing.

An adult female taken March 9 during the storm. Said to be occasionally driven out of the mountains by storms, although Mr. Willard tells me he has never seen a Cedar Waxwing in Arizona. My bird was alone, was bedraggled and half starved, for it had literally stuffed itself with pepper seeds. The whole digestive tract was crammed with these seeds, and needless to say, quite fragrant. The only specimens displayed in the museum are three in number, and labelled as follows:

Female, Yuma, June 4, 1899.

Male, Tucson, May 13, 1887.

Female, Tucson, May 14, 1887.

Lanius ludovicianus excubitorides.—White-rumped Shrike.

Rather common. One was seen to attack an Inca dove, drag it to a hedge, and decapitate it. I watched the body until it was carried away by a raven.

Dendroica coronata.—Myrtle Warbler.

One seen January 28.

Dendroica auduboni auduboni.—Audubon's Warbler.

Abundant. The February birds were all in dull, streaked winter dress, the March birds molting.

Geothlypis trichas subsp.—Yellow-throat.

First seen March 17. Mr. Willard writes me that the "early spring birds appear to be migrants on their way north and different from the breeding ones."

Toxostoma curvirostre palmeri.—Palmer's Thrasher.

Abundant. In full song and starting nest building when we arrived January 25. Said to be quite harmful in the fruit season; at one ranch some 200 were shot one spring in the strawberry and dewberry patches. Some fifteen nests were found in an area half mile square adjoining town. All were in the cholla cacti and contained usually three eggs; though often only two. March 5, two tiny black-haired young, although most of the nests contained complete sets. Their nests are large and bulky, average inside measurements 3.5x4.00x3 inches deep. Besides fine stems and rootlets the nests often contained hair, feathers, and old rope and twine. One bird taken had its leg off at the knee joint and was quite lousy.

Toxostoma bendirei.—Bendire"s Thrasher.

Not so common as Palmer's. April 3d, first set of two eggs, incubation started. The average inside measurement of nests were 3.5x3.5x2.5 inches deep, and they contained string, cotton, hair, cheesecloth, chips of newspaper and a few feathers. The stomach of the one specimen taken contained the elytra of small black beetles, white larvæ and some unknown pupæ.[1]

Heleodytes brunneicapillus cousei.—Cactus Wren.

Nesting commonly in the cacti out on the mesa. April 6, nest with three young ready to fly; nest with four young about five days old; nest with three eggs fresh. The sides of telephone poles and roofs of buildings are favorite vantage points.

Salpinctes obsoletus obsoletus.—Rock Wren.

Common on rocky hillsides. One came regularly to search the woodpile for grubs after I had split the wood each morning. I was told of a nest of this species that had three nails built into it!

Regulus calendula calendula.—Ruby-crowned Kinglet.

Became abundant after February 15; quite common before this date.

Polioptila cærulea obscura.—Western Gnatcatcher.

This form, as well as *P. plumbea*, were common at all times roving over the mesa. The stomach of one specimen was full of gnats, and its plumage full of lice.

[1] For further accounts of the nesting of Arizona Thrashers see Condor, Vol. XI., pg. 49.

***Planesticus migratorius popinquus.*—Western Robin.**

Only a few were seen in town during our stay. They were sitting quietly in the trees.

***Sialia currucoides.*—Mountain Bluebird.**

A roving flock seen February 19. Irregular winter visitant.

AN UNUSUAL FLIGHT OF WARBLERS IN THE MISSOURI VALLEY.

BY T. C. STEPHENS

An especially interesting flight of warblers was noted at Sioux City during the spring of 1913. The wave apparently first reached this point on May 8, but was more marked on the 9th and reached its maximum on the 14th and 15th. My records show that there had been a good deal of rain and cloudy weather prior to the arrival of the wave. May 3 was mostly cloudy, and was followed by three clear days. May 7 was cloudy and rainy; the 8th and 9th were cloudy and cold with some rain. On the 10th it cleared up but was still cool. By the 13th it was still clear, but was cloudy again on the 14th and 15th with rain both nights. An analysis of the weather conditions cannot be further attempted for more complete data covering a greater extent of the Missouri valley would be required to reach any significant facts. It will be noticed, however, that the warblers were present in considerable numbers during both clear and cloudy or cool weather.

The records when arranged as in the accompanying table show at a glance the wave as it came under the writer's observation. To many it may seem quite meager, but nothing like it has been witnessed by the writer in the five years of his observations at this point. The abundance of these small birds with bright colors attracted the attention of many people who were not accustomed to notice birds. Some more or less regular migrants of other years are singularly absent from the list, viz, the Palm Warbler, and the Mourning Warbler. The list is made up of records on both sides of

the Missouri river, in Nebraska and Iowa, but no distinction is made for the present purpose. May 10 and 17 represent all-day field trips; on the other days observations were entirely on the College campus and its immediate vicinity.

With the exception of a few of the species which breed in this locality, such as the Yellow warbler, the Redstart, the Maryland Yellow-throat, and the Yellow-breasted Chat, the Tennessee Warbler was the only one which I heard in song.

Below are a few notes on each species which are intended to show briefly the general status of these warblers in this vicinity in order that this year's records may have a proper setting.

1. Myrtle Warbler (*Dendroica coronata*).—This is a regular and very common migrant every year. This season, however, it was not observed with quite the usual frequency.

2. Yellow Warbler (*Dendroica æ. æstiva*).—A most abundant summer resident.

3. Black-poll Warbler (*Dendroica striata*).—A regular and common migrant in the spring, and more or less common also in the fall.

4. Black and White Warbler (*Mniotilta varia*).—This unobtrusive little warbler seems to be quite irregular from year to year. In 1912 it did not come under my observation at all. To see two or three in a single day, and without making any special search, makes this species seem almost abundant.

5. Black-throated Green Warbler (*Dendroica virens*).—Was noted several times. It has been observed occasionally in other years and is probably a regular migrant, although by no means common.

6. Wilson Warbler (*Wilsonia p. pusilla*).—Would be considered tolerably common this season. It was observed on a number of occasions, and in widely separated areas. Up to this year I have regarded this species as rather rare. While specimens were not taken, I hardly think there is any possibility of our having confused this bird with the Pileolated Warbler (*W. p. pileolata*), whose range is said to reach Nebraska. These warblers impress one with their activity, and their habit of picking insects from leaf or flower while pausing on the wing. Several years ago I saw one chased into a thicket by a small hawk, probably a sharp-shinned.

7. Redstart (*Setophaga ruticilla*).—A regular and tolerably common migrant, and occasionally breeding here. This year their

numbers seemed greatly augmented during the few days of migration.

8. Maryland Yellow-throat (*Geothlypis t. trichas*).—The form found here is often referred to as *G. t. brachidactyla*. It is a very common summer resident, and was present this spring in about the usual numbers.

9. Grinnell Water-Thrush (*Seiurus noveboracensis notabilis*).—A migrant. The Water-Thrushes were seen more frequently than my records show, because it was often difficult at a distance to satisfy one's self of the identity of this species from *S. motacilla*. I suspect, however, that if circumstances had taken me more often to its natural haunts it would have been found to be tolerably common. One of my records this year was obtained on the College campus, several miles from the nearest water.

10. Magnolia Warbler (*Dendroica magnolia*).—This species furnished one of the surprises. On the basis of my own observations I have considered this species rare in this region. This year, however, it must be credited with being abundant during the few days of its passage. It was observed practically every day and was well distributed. More inquiries were made about this little bird than all the other warblers put together.

11. Oven-bird (*Seiurus aurocapillus*).—This bird is considered a common resident here by other observers, and I have been chagrined not to have seen it until this spring. However, one of my records this season was made on the College campus, and another in a private yard a few blocks away. The other records were ecured in the field where they might be expected.

12. Blackburnian Warbler (*Dendroica fusca*).—This must be rather a rare species for the Missouri valley. I have not before come across it, and no record of its occurrence in western Iowa appears in Anderson's *Birds of Iowa*. Bruner, Walcott and Swenk credit Aughey with having occasionally found it in eastern Nebraska. A few records of its occurrence in the lower Missouri valley are given in Widman's *Birds of Missouri* (p. 229). I can add a positive record for Sioux City, May 13, 1913. On the following day Mr. Arthur Lindsey saw two on the College campus.

13. Tennessee Warbler (*Vermivora peregrina*).—A regular and abundant migrant. I believe that, from year to year, this warbler will stand second only to the Yellow Warbler in abundance. Its migration seems to cover a longer period than other members of the family.

14. Cape May Warbler (*Dendroica tigrina*).—It seems to be generally agreed that this species is rather rare in most of the interior, at least. Two records are published from Nebraska, but

none from western Iowa. On May 14 I observed one in a cherry tree on the College campus and was able to make a positive identification. On the following day I was called to the office of Mr. Peters to see a captive bird which had been picked up from the street under some wires. It proved to be a male Cape May Warbler. As it had apparently recovered from any shock or injury Mr. Peters released it.

15. Chestnut-sided Warbler (*Dendroica pensylvanica*).—I do not get to see this species more than once or twice in a season. I noted it in 1909 and 1910, but missed it entirely in 1911 and 1912.

16. Nashville Warbler (*Vermivora r. rubricapilla*).—I have no other records of this species except those of this season.

17. Bay-breasted Warbler (*Dendroica castanea*).—The only previous record of mine is of June 4, 1910, on the College campus. This year Miss Pearl Woodford told me of seeing one at Sergeant Bluff on May 10. On the 14th Mr. Arthur Lindsey saw two on the campus; on the 15th I saw one; and on the 18th one was reported to me by Paul Chipperfield.

18. Louisiana Water-Thrush (*Seiurus motacilla*).—While only a few records appear in the table, it seems to be the more common of the two Water-Thrushes.

19. Yellow-breasted Chat (*Icteria v. virens*).—Not by any means common from year to year. This year my two records are probably of the same bird, or of a pair.

Sioux City, Ia.

THE WILSON BULLETIN

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Editorial

The increasing interest shown in the nesting behavior of birds and the considerable attention given to studies of this sort are indications of a rapid increase in our knowledge of the birds in this important field of inquiry. As the data accumulate and generalizations from them become more and more reliable we predict that light will be thrown on a number of problems which now seem all but hopeless of solution. We hope that the number of competent students of nesting activities will greatly increase the coming summer.

The editor enjoyed the thirty-first stated meeting of the American Ornithologists' Union which was held in New York City November 11-14, at the American Museum of Natural History. In some respects it was the best meeting which he has been privileged to attend. A larger number of Fellows were in attendance than ever before and the attendance of out-of-town members was gratifying. We were pleased to welcome several, for whom this was their first meeting. There should be a much larger attendance every year. Toward this end it is proposed to hold the 1914 meet-

ing in Washington, D. C., early in April to accommodate many members who cannot attend the November meeting because of school duties at that time. For the first time in the history of the Union the elections of Fellows resulted in filling up that class to the limit of fifty. Five were elected to the class of Members, which is the limit set for any one stated meeting. A large number of Associates were added to the membership. The finances were shown to be in a satisfactory condition. It is to be regretted that it does not now seem feasible to hold meetings of this organiza- in the interior of the country. The need for such a meeting will be only partly met by the proposed spring meeting at San Francisco in connection with the Panama Exposition in 1915. Members living in the Mississippi Valley might well bestir themselves for inviting the Council to appoint a meeting somewhere in the central part of the country.

So many persons are now interested in birds there is hardly a community where more than one bird student cannot be found. We offer the suggestion of a plan of study which is believed would result in much valuable information. All interested persons in a community arrange for simultaneous study in any selected region, each person studying a different locality. When the work is completed merge the different individual reports into one and study the results. In this way the whole region could be covered in a single day and the status of the bird life in it would be more accurately learned than where all go on a stated excursion together. If such studies could be carried through the year the result should be a more accurate list of the birds of that particular region than could possibly be obtained by one person in any number of years of study. But if such a scheme cannot be worked out for the whole year it should be entirely possible to arrange for such coöperative studies for one day at a time. It might well be tried for some January day to learn of the winter population, and as many days as possible during the spring migration, to determine the relative abundance of species on a given day as well as keeping track of the migrations as a whole. Try it.

A large list of nominations for membership is nearly ready for submission to the members at large. It cannot be printed in this issue of the Bulletin, but will be submitted through the mails a little later.

General Notes

THE WESTERN GREBE IN OHIO.

On Tuesday morning, October 28th, 1913, while passing Lake Glacier in Mill Creek Park, near Youngstown, Ohio, I observed a Grebe on the lake, which I was satisfied was the Western Grebe (*Aechmophorus occidentalis*). I consulted Mr. Volney Rogers, the park superintendent, and he agreed with me that the appearance of the Western Grebe in this locality was of sufficient importance to justify the taking of this bird, and on Thursday, October 30th, I shot it. The skin of this Western Grebe is now at the Carnegie Museum in Pittsburgh, Pa.

GEORGE L. FORDYCE.

THE CARDINAL ARRIVES AT LANSING, IOWA.—In a report of the northward advance of the Cardinal, which I gave in the last number of Wilson Bulletin, it was stated that the Cardinal had not yet reached Lansing. My correspondent at that place, Miss Martha H. Hemenway, writes me under date of November 11, 1913: "The Cardinals have visited us at last, or at least this is the first sight of them I have ever had here. A few days ago I noticed some strange birds in the trees quite high up, but not near enough to be sure of their beings Cardinals. Later I saw some on the river bank and watched them closely until they flew; one came near me, and then I had no doubt of them, as they showed a flash of color, which identified them without question."

This extends the range of this species to a point within a few miles of the northern boundary of Iowa. Their first appearance in new territory, almost without exception, has been in the cold months of the year.

ALTHEA R. SHERMAN.

National, Iowa.

Correspondence

Editor The Wilson Bulletin:

DEAR SIR—If you can spare me a little of your valuable space in the Bulletin, I should very much like to invite the attention of ornithologists to the work just published by Mr. Jno. Henry Gurney, of Keswick Hall, Norwich, England, entitled "The Gannet, a Bird with a History." This beautiful volume, so perfect in all the requirements of book manufacture, is from the presses of Messrs. Witherby and Company (326 High Holborn, London), and it is most assuredly not only a credit to that House, but entirely worthy of the pen and labor of its distinguished author.

In my opinion, this work in its treatment exemplifies — anatomically, ecologically and otherwise — one of the very best methods of setting forth, in popular fashion, what we have learned up to date about some particular bird, — the Gannet in the present instance. It gives us maps of the world and special localities presenting the "Distribution of the *Sulidæ* ('Gannets and Boobies')"; there are fine half-tone reproductions of photographs showing many places, islands, and so on, where these birds still breed or are found in large numbers; there is a fairly good bibliography presented, and a history of the names of the Gannets. The ecology is admirable, and there are beautiful colored plates of eggs and young. We also have chapters on development; on the embryo and allied subjects, with fine, illustrated chapters on the anatomy of the Gannets which, while sufficiently extensive, are of a character so well within the lines of popular treatment as to be not only quite readable, but in no way calculated to alarm the pure systematist or to ruffle the waters of even-going ornithology.

We find some excellent history on the "Mortality among Gannets," "Gannets as Food," "Attainable Ages of Gannets," and even an admirable, illustrated chapter on "The Parasites Infesting Gannets," with a brief treatment on the known examples of fossil forms of these birds.

We have many bird-forms in this country which it would well repay some broad ornithological writer to work up as Mr. Gurney has the Gannet, — birds, too, which are now being rapidly exterminated. Among these I would suggest the flamingo, the limpkin (*Aramus*), road-runner (*Geococcyx*), and others.

Let us trust that American ornithologists will appreciate Mr. Gurney's "Gannet," and that many copies of it will be sold in this country.

Faithfully yours,

R. W. SHUFELDT.

Publications Reviewed

The Birds of Connecticut. State of Connecticut State Geological and Natural History Survey, Bulletin No. 20. By John Hall Sage, M.S., Secretary of the American Ornithologists' Union, and Louis Bennett Bishop, M.D., Fellow of the American Ornithologists' Union, assisted by Walter Parks Bliss, M.A., Hartford, 1913.

In an Introduction of four and a half pages the location of the state is given, and a glimpse of its topography and faunal areas, which are defined as Alleghenian over the greater part of the state, with a small area of Canadian in the north-western corner, or at least Canadian affinities. We learn that the first definite state list was prepared by Rev. James H. Linsley and published in 1843, the second by Dr. C. Hart Merriam in 1877, and thirty-four years after the first list, while the present list appears after an equal lapse of time. The Introduction closes with a plea for accuracy in making records which can be certainly secured only when specimens of unusual birds are collected. It is clearly shown that such collecting as this entails does not menace the bird life of any region.

In the treatment of the 329 native species known to occur within the borders of Connecticut the names and sequences of the Check-List of the American Ornithologists' Union are followed, but the numbers happily omitted. Divisions are made including orders, suborders, families, subfamilies, the scientific name followed by the vernacular name. There follows a statement of the status of the species in the state, the earliest and the latest seasonal records, breeding records of breeding birds and earliest and latest migration records of transient birds. In the case of unusual or rare occurrence all records are given. A statistical summary shows that the list comprises 80 resident species, 78 summer residents, 38 winter residents, 124 transient visitors, and 80 accidental visitors. There are five introduced species included. The grand total shows 334 for the state, which seems large for so small a state as Connecticut, with practically but one life zone. This may not appear so unlikely when it is known that some 150 persons are named as contributors in one way or another. In a bibliography of 57 pages there appears a further reason why the number of birds recorded in the state is so large. The book closes with about a hundred pages on Economic Ornithology, by Dr. Bishop. The treatment is systematically by groups, but many species are separately treated where their importance warrants such separate treatment. An excellent index adds much to the usefulness of the book. The typography and paper leave little to be desired. As a contribution to

faunal and economic ornithology it is a most welcome addition to our literature, and furnishes a model for similar works in other places. We congratulate the authors. L. J.

Some Birds of the Fresno District, California. By John G. Tyler. The Cooper Ornithological Club. Pacific Coast Avifauna Number 9. Hollywood, October 1, 1913.

This paper makes no claims to completeness, but is rather presented now that it may furnish a working basis for a future complete survey of the region which occupies the exact geographical center of the state. It is a lowland of not over 400 feet elevation, and lies within the Lower Sonoran Zone. The author states that the steady reduction of the swampy areas by drainage marks the doom of such nesting birds as depend upon the cover afforded by such a swampy environment. The check-list of species, which precedes the General Account of the Species, gives 161 species. The treatment is systematic, and each species named is accompanied with copious annotations relating to the occurrences, relative abundance, migration, nesting, food habits, and many side lights upon the life of the birds. We are seldom treated, in a paper of this sort, with such a wealth of interesting things as this author presents. May his tribe increase! In paper, typography, and general appearance this latest number of the California Avifauna series maintains the high standard set at the inception of the series. L. J.

Smithsonian Miscellaneous Collections. Three papers by Edgar A. Mearns.

Vol. 61, No. 10. Descriptions of four new African Thrushes of the Genera Planesticus and Geocichla. August 11, 1913. One is a new species — *Planesticus hellеru* — from Mount Mbololo, altitude 4,000 feet, east of Mount Kilimanjaro, British East Africa, collected November 9, 1911, by Edmund Heller, on the Paul J. Rainey African Expedition. The other described forms are subspecies, one of Planesticus, the others Geocichla.

Vol. 61, No. 11. Descriptions of six new African Birds. August 30, 1913. "Four of the forms here described are from the collection made by the Childs Frick African Expedition, 1911-12; and two are from the Smithsonian African Expedition, 1909-10 collection, made under the direction of Col. Theodore Roosevelt." Five were collected by the author and one by Childs Frick. Five are new subspecies of Cisticola, one of Pyromelana.

Vol. 61, No. 14. Descriptions of Five New African Weaver-Birds of the Genera Othyphantes, Hypargos, Aidemosyne, and Lagonosticta. September 20, 1913. "Four of the forms here described are from the collections made by the Childs Frick African Expedition,

1911-12, and one from the Smithsonian African Expedition collection, 1909-10, under the direction of Col. Theodore Roosevelt." All were collected by the author. Two are new species and three subspecies. L. J.

Notes on the Occurrence and Nesting of Certain Birds in Rhode Island. By Harry S. Hathaway. Reprinted from The Auk, Vol. XXX, No. 4, Oct. 1913.

"During the interval which has elapsed since the publication of the 'Birds of Rhode Island' by Howe and Sturtevant in 1899, and the supplement thereto in 1903, many records of rare and interesting birds have accumulated and are herewith published as a contribution to our knowledge of the avifauna of this state. The Western Willet, Arctic Three-toed Woodpecker, Evening Grosbeak, and Nelson's Sparrow have been added to the list of birds of the state. The Breeding of Henslow's Sparrow, Black-throated Blue Warbler, Pine Warbler, Water-Thrush, Winter Wren, and Hermit Thrush has been established, while an increase in numbers of the Laughing Gull, Common Tern, Sparrow Hawk and Carolina Wren has been noted." L. J.

THE ONTARIO NATURAL SCIENCE BULLETIN, No. 8, 1913.

In an article entitled "Conditions Against Which Bird Life is Contending, by Mr. Fred Mitchell, the Pileated Woodpecker and Winter Wren are mentioned as having entirely disappeared from the region. The forces mentioned as operating to decrease the bird life are the destruction of forests, the red squirrel, bird dogs allowed to run wild, and the destruction of nests and birds by boys and thoughtless men. A strong plea is made for the establishment of real bird preserves, where the adverse conditions may be reduced to a minimum. L. J.

BLUE-BIRD, FORMERLY NATURE AND CULTURE.

This much improved Ohio Audubon Monthly, under the editorial management of Dr. Eugene Swope, migrates regularly from 4 West Seventh Street, Cincinnati, Ohio. It is one of the best magazines devoted to the Audubon Society cause. The slight confusion regarding the number of the volume which seems to have been incident to the change of name will doubtless be remedied.

ORNITHOLOGICAL JOURNALS.

The Auk. The July and October issues have appeared since this journal was noticed in these pages. Of the ten articles in the July number the leading article by Witmer Stone, "Bird Migration Rec-

ords of William Bartram, 1802-1822," and "The Nest Life of the Sparrow Hawk," by Althea R. Sherman, are the most noteworthy. Mr. Stone appends a comparative table of arrival dates to show comparisons between Bartram's dates of arrival of 26 common species and the arrivals as noted by the members of the Delaware Valley Ornithological Club. While there are some considerable difference shown in the two records Mr. Stone concludes that there has been appreciable change in the time of arrival. The writer fully agrees with Mr. Stone in his contention that for comparative purposes the arrival of the "bulk" is more likely to yield reliable data. It must also be true that data gathered by a large number of observers in a given region must be more reliable than if records of one or few observers are taken. But after all constant daily study of bird movements by competent observers is the only sure means of securing data of sufficient accuracy to warrant sweeping general conclusions. The station of one observer may be within a definite fly-line, while that of another not many miles away may be wholly without any definite fly-line. The one is pretty certain to obtain earlier dates of arrival than the other. Thus the "personal equation" may be largely a "locality equation." All factors must be considered. The October number contains eight papers, besides the usual long list of interesting and valuable General Notes. Of these eight papers the leading one "A Biological Reconnaissance of Okefinokee Swamp: The Birds," by Albert H. Wright and Francis Harper, with six plates, and "Morning Awakening and Evensong. Second Paper," by Horace H. Wright, are perhaps most worthy of notice. One of the most valuable features of the Auk is the careful and full reviews of recent literature. L. J.

The Condor. Nos. 4 and 5. The leading article of No. 4 is a valuable comparative study of the eggs of the North American Limicolæ, by Dr. R. W. Shufeldt, with six full page half-tone plates representing 25 species. The remarkable similarity in shape and markings of all of the eggs, except those of the three species of Oystercatcher, and their clear dissimilarity both in shape and markings, and their similarity to nests of the Longipennes might afford a legitimate excuse from some questionings in regard to the two groups. Dawson's all-day list at Santa Barbara is a large one, and his prediction, amounting to almost a challenge to the Oberlin region, may warrant comment. It is hardly likely that another all day individual list will be made in the Oberlin region; but that there will be a company list made by as many competent students as can be induced to coöperate, each two doing careful work in some restricted and easily covered area, is as certain as available persons will

make it. In such an all day study Oberlin challenges the world! The leading article of No. 5, by H. S. Swarth, "A Revision of the California Forms of Pipilo maculatus Swainson, with Description of a New Subspecies," with a map showing the ranges of the five forms, is a welcome paper on a difficult subject. The new form is *P. maculatus falcinellus*, Sacramento Towhee. This new form occupies the range formerly ascribed to *megalonyx*, which now is shown to belong in the southern part of the state. Mr. J. Grinnell's "Call-notes and Mannerisms of the Wren-Tit" is an intimate study of this wee bird. Other articles and notes maintain the high standard of this magazine of western ornithology. L. J.

Bird-Lore. Vol. XV, Nos. 4 and 5. The continuation of the color plates of the sparrows and color plates in the Audubon Department adds five excellent color plates to an already long list. In No. 4, the student of faunal ornithology will find the leading article, "The 'Old Man,' A Maine Coast Bird Study," a valuable addition, while students of nesting life will read with pleasure the story of "Five Little Waxwings and How they Grew." The law to protect migratory birds is printed in full. In both numbers the migrations and plumages of the sparrows are continued. No. 5 continues the presentation of intimate studies of birds in most of the articles. In both numbers the "Notes from Field and Study" are well selected and interesting. We regret that space will not permit of a more extended review. L. ..

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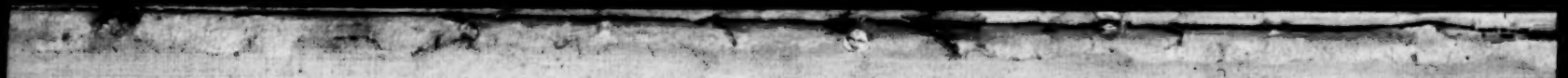
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